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CHARACTERISTICS OF AN EPIDEMIC OF SMALLPOX
GERERE HAMLET, NIGERIA - 1968

by

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An intensified programme of surveillance, case investigation and containment of smallpox has been a prominent feature of the eradication programme in Nigeria. These investigations are specifically intended to promptly control outbreaks of smallpox, to ascertain why they have occurred (particularly if in previously systematically vaccinated areas), and, if necessary, to determine how the programme should be modified to prevent subsequent outbreaks.

An outbreak of particular interest occurred in Gerere Hamlet in western Sokoto Province, Nigeria, early in 1968.

I. Introduction

Gerere Hamlet has a population of 200 people consisting of semi-nomadic and settled Fulanis as well as Hausas. The semi-nomadic Fulanis live in temporary huts made of straw mats outside the village. They are strictly herdsmen who graze their cattle as far south as the Niger river (70 miles). The settled Fulanis live in permanent structures in the village, but continue to keep cattle as well as grow rice during the wet season. The Hausa population comprises about one-half of the population and subsist solely as farmers.

On 1 April, an informal verbal report regarding smallpox cases in Gerere was received by the Smallpox Eradication/Measles Control Unit in Kaduna; the epidemic was investigated on 5-8 April.

Kalgo district was vaccinated by the mass vaccination programme in November 1967. At that time, 58 745 vaccinations were performed in a population of 65 722 (1963 census). A sample assessment of the 464 831 persons in the districts revealed 96.9 per cent. coverage. Four villages in Kalgo district were included as part of the sample; all showed a coverage of greater than 95 per cent.

During the vaccination campaign, the villagers in Gerere were asked to go to a vaccination site located eight miles away. Apparently, the villagers considered the walk too far as only seven people were vaccinated at this site although some had been vaccinated at other sites. Another vaccination site was located one-and-a-half miles from Gerere but lies in another district; the villagers were not informed to go there to be vaccinated.

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II. The epidemic

It is unknown who introduced the disease into the village. The first case occurred in a five-year old girl, a semi-nomadic Fulani (Artowo), during the first week of January. The family denies any strangers visiting the compound or any travel prior to the illness. The last known case of smallpox in the area occurred in a semi-nomadic Fulani on 13 December in Bayawa district 45-50 miles north. This was at a time when a great many Fulani were moving south in search of better pasture for their cattle. It is also known that the pastoral Fulani hide smallpox cases very commonly to prevent isolation and separation from their families and cattle. It is possible, therefore, that a case, or cases, of smallpox came south from Bayawa district resulting in Artowo's illness.

For eight weeks and four generations of disease, transmission was confined to the first compound of semi-nomadic Fulanis (Fig. 1). During the ninth week, the epidemic spread into the village and 10 cases or more occurred weekly during weeks 11, 12, 13 and 14. The first compound affected within the village was a group of settled Fulanis. The Hausa population was last to be affected as the first Hausa did not become ill until week 11. By the time the investigation was made, 5 April, 62 cases had occurred among 203 people. Thirteen cases occurred in semi-nomadic Fulanis, 30 cases among the settled Fulanis and 19 cases among the Hausas. All cases occurred in unvaccinated individuals except for one 12-year old female who had been vaccinated four years previously.

The epidemic was not reported through the usual surveillance system (i.e. village head notifies district head, who notifies the Native Authority Health Officials). Thus control measures were not started until the epidemic was discovered accidentally during the twelfth week of the outbreak. The usual measures were instituted by the Native Authority vaccinators who were sent to the village on 20 March. These measures proved to be ineffective as the lanolated vaccine which was used was impotent and only two people received takes. None of the patients were isolated prior to the arrival of the Native Authority Health Team, thus the epidemic was virtually undisturbed for twelve weeks and seven generations.

All cases were acquired by natural infection; there was no evidence of variolation being practiced.

Effective control measures were instituted on 6 April with the use of freeze-dried vaccine administered by multiple puncture technique. At this time, the entire village was vaccinated irrespective of their past history of smallpox or previous vaccination.

At least two known exportations of smallpox occurred from the outbreak. The first occurred during the first week in March and resulted in five additional cases in the village of Mai'dahini, one-and-a-half miles south. The second exportation occurred during the last week of March and involved a two-year old child who was from Gerere, but became ill in Mai'dahini and was isolated there. No further cases resulted.

Only one death occurred among the 62 cases. A two-year old Hausa girl died on 4 April, nine days after the onset of her rash. Two people were blinded due to smallpox. Both of these people had punctate scars of about 2 mm in diameter on their corneas bilaterally. They continued to have light perception and, in fact, were quite sensitive to intense light. One woman suffered a spontaneous abortion during the fifth month of her pregnancy. One other woman developed the disease during the ninth month of her pregnancy but recovered without ill effect and delivered an emaciated child. This child was feeding poorly at the time of the investigation, nine days after its birth.

III. Epidemic investigations

All compounds in the village were visited to determine the degree of exposure and level of immunity to smallpox within that compound. All individuals were asked regarding previous vaccination, smallpox and variolation. Close observation was made as well for vaccination scars, facial scarring of smallpox and evidence of a variolation scar. All smallpox cases were appraised by a medical officer. The chain of transmission between compounds was traced to the extent possible.

Results

The attack rate for all individuals in Gerere was 30.3 per cent. (Table 1). The sexes were affected equally, but 75.8 per cent. of the cases were in children below the age of 15 years. This is accounted for, in part, by the large number of children in the village and the lower level of immunity in this age group (Table 2). None of the children below five years had ever been vaccinated, and only 17.4 per cent. of those five to 14 years of age had vaccination scars. In the adult population, however, the number of people who were immune increased with each age group, with 45 per cent. of all adults having been successfully vaccinated at some time.

As shown in Table 3, attack rates among susceptibles actually increased with increasing age. Over-all, just over half of all susceptibles developed smallpox.

Examination of the attack rates among the various ethnic groups that comprise the village reveals that the Hausas had the lowest attack rate, approximately one-half that of the settled Fulanis but this is accounted for by the higher level of immunity in these people (Table 4). All three groups had approximately the same experience with variola in the past, but twice as many Hausas had been vaccinated as compared to the Fulanis. When the susceptible population alone is considered for all three groups, the attack rates are very similar.

Compound A

The first compound infected was of special interest. The compound consisted of three families and 24 people who lived in three huts made of straw mats located about 50 yards north of the village. Fifteen people were susceptible to smallpox prior to the epidemic. All members of the compound had close intimate contact with each other except when they were away taking care of their cattle. Six generations of smallpox and 12 cases occurred in this compound over a three month period of time, illustrating the low infectivity rate of smallpox and its ability to continue transmission for long periods of time in small pockets of susceptibles.

IV. Discussion

The Gerere smallpox epidemic illustrates several obstacles that must be overcome if smallpox eradication is to be achieved in northern Nigeria.

First the epidemic occurred in an area where the mass vaccination programme was completed. However, two problems existed that left pockets of susceptibles after the teams were finished. The pastoral Fulani were inadequately vaccinated as they were constantly moving through the area. In small villages and hamlets, such as Gerere, vaccination coverage may be inadequate due to long distances from the vaccination sites and poor communications. The assessment system in existence at that time would tend not to pick up these small villages, as the method of sampling used selected villages in proportion to their population (i.e. the larger the village, the greater the probability that it would be sampled). The newly devised assessment programme should help solve this problem, as a large number of small hamlets will be sampled.

The surveillance system that is now being developed will have to be sensitive enough to pick up even small isolated outbreaks, as transmission of smallpox can continue for long periods of time in extremely small susceptible populations such as Compound A.

Control measures must consistently include the use of freeze-dried vaccine, vaccination of all susceptibles and isolation of all cases. Control measures instituted in Gerere with inadequate vaccine permitted an additional 20 cases and one death to occur that could otherwise have been prevented.

This epidemic also illustrates several important features of smallpox epidemiology in northern Nigeria.

First, the disease primarily affects children and young adults. Second, many adults have previously had smallpox, acquired by means of natural infection as well as variolation. The variolation scar that was present was located on the dorsum of the left forearm. There is no evidence that variolation was used during the present epidemic. Third, smallpox transmission is maintained by sporadic epidemics in susceptible populations that are connected by transhumance of various sorts. It seems likely that nomadic Fulanis will play a relatively more important role in future transmission in the north unless they are approached specifically and effectively vaccinated.

TABLE 1. AGE SPECIFIC ATTACK RATES AMONG ALL INDIVIDUALS IN GERERE

Age	Male			Female			Total		
	Population	Smallpox cases	Attack rate %	Population	Smallpox cases	Attack rate %	Population	Smallpox cases	Attack rate %
0-4	22	9	40.8	21	8	38.0	43	17	39.6
5-14	27	10	37.1	37	20	59.0	64	30	46.8
15-29	16	3	18.7	35	7	20.0	51	10	19.7
30-44	18	3	16.7	15	2	13.6	33	5	15.3
45+	9	0	0	3	0	0	12	0	0
Total	92	26	28.3	111	37	33.3	203	62	30.3

TABLE 2. PROPORTION OF PERSONS WITH VACCINATION SCAR

Age	Number in village	Number with vaccination scar	% with vaccination scar
0-4	43	0	0
5-14	64	11	17
15-29	51	21	41
30-44	33	18	55
45 and over	12	4	33
Total	203	54 ^a	38

^aNine additional gave a history of vaccination but it is unknown whether or not a scar was present.

TABLE 3. PROPORTION OF POPULATION SUSCEPTIBLE AND ATTACK RATES AMONG SUSCEPTIBLES

Age	Number in village	Number susceptible ^a	Cases of smallpox	Attack rate (%)
0-4	43	43	17	40
5-14	64	53 ^b	29 ^b	55
15-29	51	14	10	71
30-44	33	6	5	83
45+	12	1	0	0
Total	203	117	61	52

^aNo vaccination or variolation scar or history of smallpox.

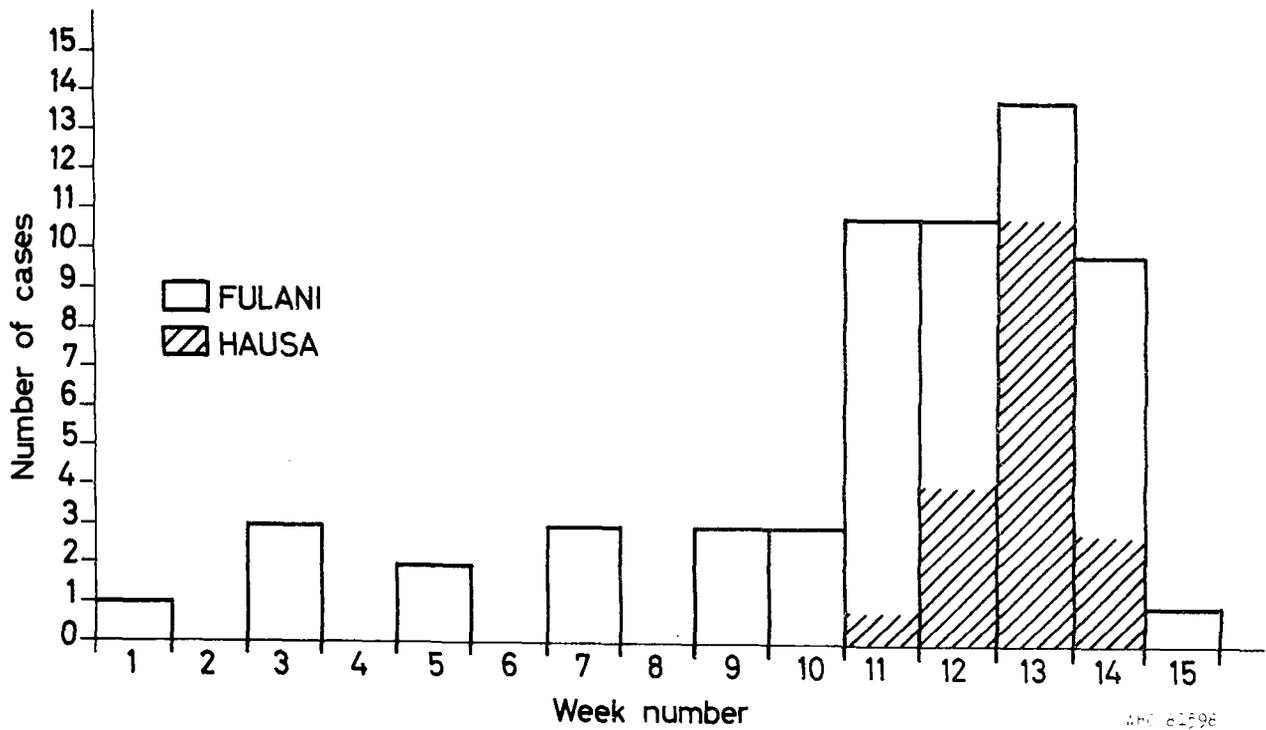
^bOne case excluded who had a vaccination scar and developed smallpox.

TABLE 4. ATTACK RATES AMONG SUSCEPTIBLES BY
TRIBAL ORIGIN IN GERERE

	Number	Number susceptible	Smallpox cases	Attack rate in susceptibles (%)
Semi-nomadic Fulani	40	24	13	54
Settled Fulani	70	49	30	59
Hausa	93	44	19	43
Total	203	117	62	52

FIG. 1

SMALLPOX CASES IN GERERE HAMLET, KALGO DISTRICT,
SOKOTO PROVINCE, NORTH-WESTERN STATE, NIGERIA
JANUARY 1-APRIL 7, 1968



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